

Asphalt Emulsion

AASHTO T-40 Sampling, Storage & Handling Procedures



North Carolina Department of Transportation

Materials and Tests Unit

Asphalt Emulsion 101

Asphalt emulsion is a combination of three basic ingredients; asphalt, water, and small amounts of emulsifying agent.

In the same process, these components are introduced into a mechanism known as a colloid mill, which shears the asphalt into tiny droplets/particles.

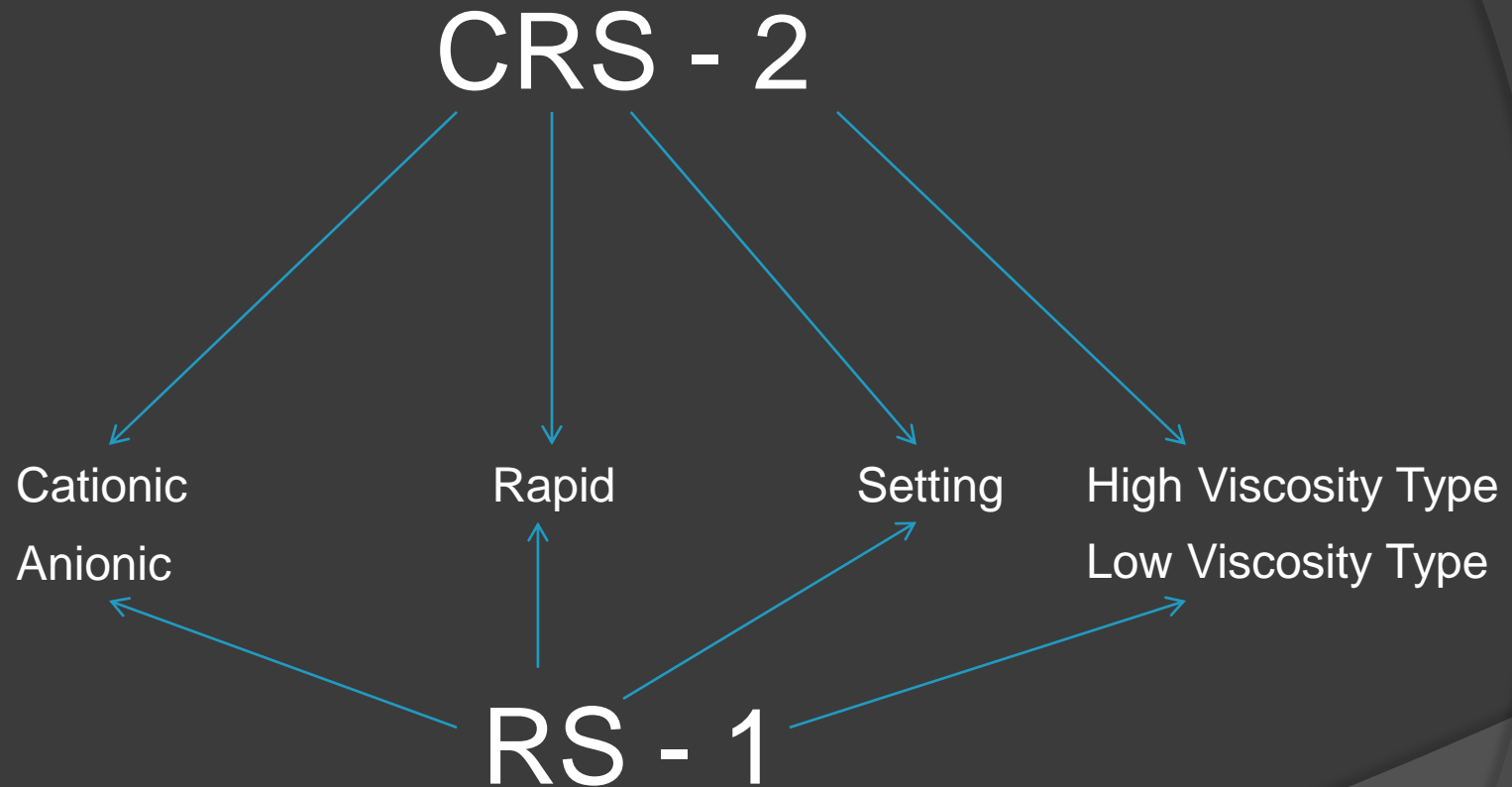
The emulsifier, which is a surface-active agent, keeps the asphalt droplets in a stable suspension and controls the breaking time.

Basic Emulsion Chemistry

The chemical system of an emulsion

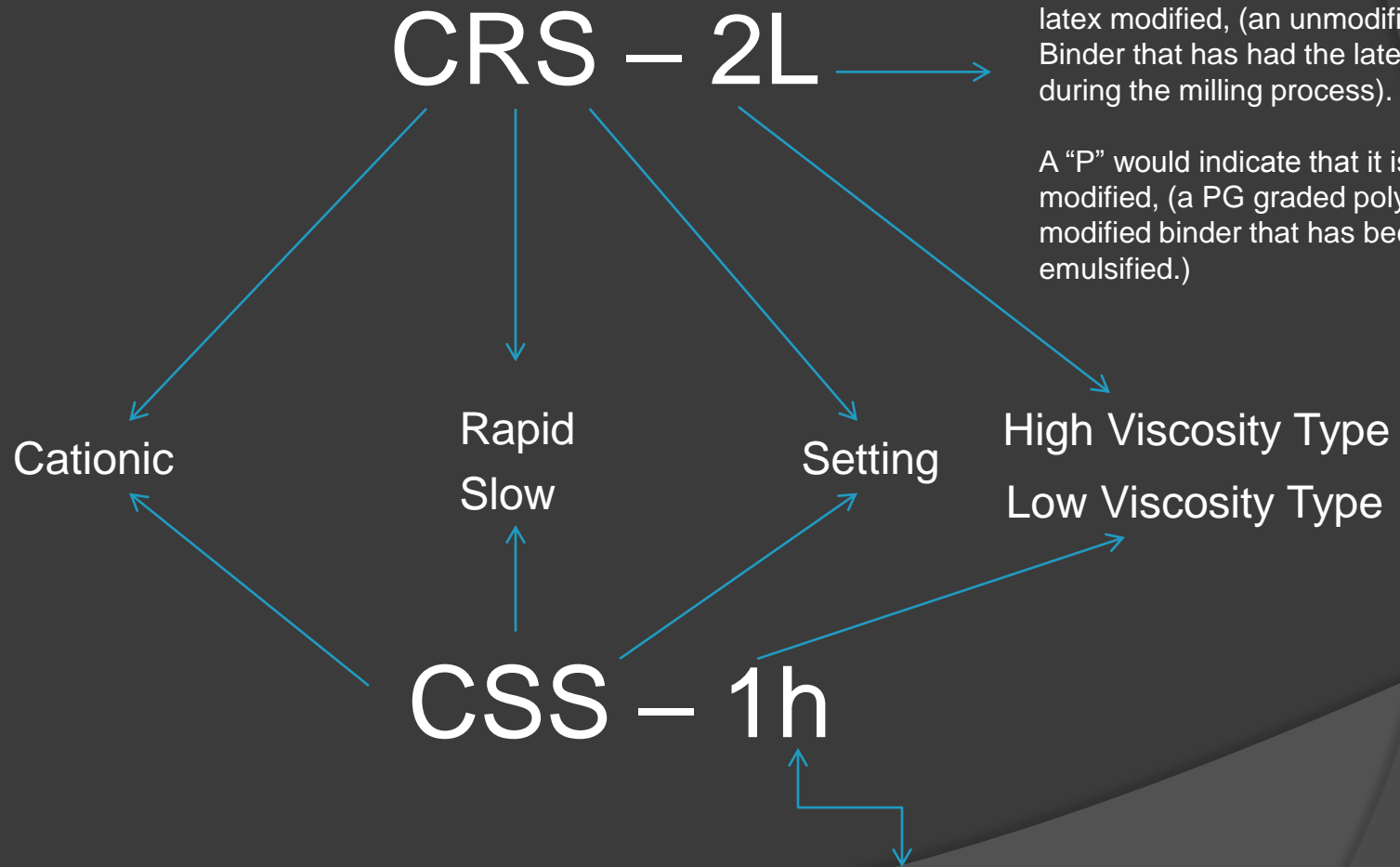
- The primary ingredients of an emulsion are the base asphalt (also known as bitumen) and water. Emulsions come in different grades but usually contain between 55 and 70% asphalt. In conjunction with the asphalt and water, asphalt emulsions contain 0.1-2% of an emulsifying agent or 'soap' which stabilizes the emulsion.
- These soaps are similar to the detergents and soaps used in typical household cleaning and personal use. The asphalt emulsions may also contain trace amounts ($< 1\%$) of other components such as pH (acidity) regulators, and viscosity regulators.

Emulsion Grades



Cationic indicates that the emulsion has a (+) positive electric charge an RS-1 would indicate that the emulsion has a (-) negative electric charge.

Emulsion Grades



The “L” following the viscosity type indicates that this emulsion has been latex modified, (an unmodified PG Binder that has had the latex added during the milling process).

A “P” would indicate that it is polymer modified, (a PG graded polymer modified binder that has been emulsified.)

The “h” following the type indicates that a hard base asphalt was used in the emulsification process.

Storage, Stability, and Handling



Storage and Stability

- ◎ The chemical system, temperature, and the particle size can determine the storage stability of the asphalt emulsion, therefore improper handling can greatly influence the storage stability of an asphalt emulsion.
- ◎ Great care must also be taken during the application of the asphalt emulsion. Factors such as application temperature, ambient environmental temperature or weather, and aggregate compatibility are just some of the factors to consider when applying asphalt emulsion.

Storing Asphalt Emulsions

- ◉ DO store as you would fluid water – between 50°F and 185°F, depending on the intended use and specific product.
- ◉ DO store at the temperature specified for the particular grade and application.
- ◉ DO NOT permit the asphalt emulsion to be heated above 185°F. Elevated temperatures evaporate water, changing the characteristics of the asphalt emulsion.
- ◉ DO NOT let the emulsion freeze. This breaks the emulsion, separating the asphalt from the water. The result will be two layers in the tank, neither of which will be suited for the intended use.
- ◉ DO NOT allow the temperature of the heating surface to exceed 212°F. This will cause premature breakdown of the emulsion on the heating surface.
- ◉ DO NOT use forced air to agitate the emulsion. It may cause the emulsion to break.

Recommended Asphalt Emulsion Storage Temperatures

Grade	Minimum Temperature °F (°C)	Maximum Temperature °F (°C)
RS-1	70° (20°)	140° (60°)
RS-2, CRS-1, CRS-2, HFRS-2	125° (50°)	185° (85°)
SS-1, SS-1h, CSS-1, CSS- 1h, CRS-1h, MS-1, HFMS-1	50° (10°)	140° (60°)
CMS-2, CMS-2h, MS-2, MS-2h, HFMS-2h, HFMS- 2s, CRS-2P, CRS-2L	125° (50°)	185° (85°)

Source: AEMA

http://www.aema.org/index.php?option=com_content&view=article&id=75:storage&catid=7:faqs&Itemid=25

Handling of Asphalt Emulsions

- Be aware of the charge of your emulsion. + or -
- Never mix different charged emulsions, such as a CRS-1 with an RS-1
- Take care when mixing same charge same grade emulsions for example; different batches of the same grade from the same producer, however different batches from different producers should never be mixed.
- Not all same charge emulsions are necessarily compatible due to possible differences in base asphalt, emulsifiers and pH.
- Avoid repeated pumping and recycling, if possible, as the viscosity may drop and air may become entrained, causing the emulsion to be unstable.

Special Field Handling NCDOT Requirements

Chip Seal Operations

Asphalt emulsions are relatively susceptible to thermal shock which can affect its stability. An emulsion can experience this thermal shock through repeated cooling and heating. Therefore please consider the guidelines below.

Material shall be a **minimum of 155° F** and not exceed a **maximum of 170° F** in the suppliers tank when delivered within two hours of scheduled delivery time.

Total rejection of shipment may be imposed for deliveries with a temperature factor in the suppliers tanker with a varying heat factor of 5° F less than the required minimum of 155° F or 5° F greater than the maximum of 170° F.

When loaded for delivery at the mentioned temperature, it will minimize the need for re-heating by Road Oil Units.

Special Field Handling NCDOT Requirements

Tack Coat Operations

Special consideration must also be given to the handling of emulsions in tack coat operations. Weather and surface cleanliness are important factors in achieving a proper coat and bonding between the asphalt layers.

An emulsion that is applied too cold will cause it to coalesce or break too slowly, an emulsion that is applied too hot will cause it to break too fast. Temperature can affect or change an emulsion's viscosity. Too hot and it becomes less *viscous or "runny", too cold and it becomes more viscous or syrup like. Please refer to the chart below for proper application temperatures.

Table 605-1
APPLICATION TEMPERATURES FOR TACK COAT

Asphalt Material	Temperature Range (English)	Temperature Range (Metric)
Asphalt Binder, Grade PG 84-22	350 - 400° F	177 - 204° C
Asphalt Emulsion, Grade RS-1H	90 - 150° F	32 - 66° C
Asphalt Emulsion, Grade CRS-1	90 - 150° F	32 - 66° C
Asphalt Emulsion, Grade CRS-1H	90 - 150° F	32 - 66° C
Asphalt Emulsion, Grade HFMS-1	90 - 160° F	32 - 71° C
Asphalt Emulsion, Grade CRS-2	125 - 185° F	52 - 85° C

Table 9-1

* Viscosity is a measure of the resistance of a fluid which is being deformed by either shear stress or tensile stress. In everyday terms (and for fluids only), viscosity is "thickness" or "internal friction". Thus, water is "thin", having a lower viscosity, while honey is "thick", having a higher viscosity.

Sampling an Asphalt Emulsion

AASHTO T40

AASHTO T40-02 _4.1

4.1 Because of the numerous types and grades of bituminous materials that are alternately shipped and stored in the same or similar containers, the opportunity for contaminating these containers with residues, precipitates, or cleaning solvents is ever present.

Numerous opportunities also exist for obtaining samples which are not strictly representative of the material or are contaminated after removal. Therefore it is incumbent upon the producer, transporter, user, and sampler to exercise continuous precaution in the sampling of these materials.

Sampling an Asphalt Emulsion

AASHTO T 40-02

AASHTO T40-02_5.1 – 5.2

- 5.1 Whenever practicable, bituminous materials shall be sampled at the point of manufacture or storage, and at such time as to allow the tests controlling acceptance or rejection to be made in advance of the shipment.
- 5.2 When the samples cannot be taken at the point of manufacture or storage, they shall be taken from the shipment immediately upon delivery.

Sample Containers

- Sample containers for emulsified bituminous materials shall be wide-mouth jars or bottles made of plastic, or wide-mouthed plastic-lined cans with lined screw caps, or plastic-lined triple-sealed friction-top caps. AASHTO T40-02_7.1.2

The NC DOT Materials & Tests unit asks that you use the container pictured below when submitting field samples.



Item #54, Jar ½ gallon plastic wide-mouth on M&T
Unit's requisition form

Field Sampling Asphalt Emulsions



Field Sampling Procedure

Procedure

- ⦿ 1. Coordinate sampling with contractor or supplier.
- ⦿ 2. Use appropriate safety equipment and precautions for hot liquids.
(safety glasses and leather gloves)
- ⦿ 3. Allow a minimum of 4 L (1 gal) to flow before obtaining a sample(s)

- ⦿ 4. Obtain samples of:

Asphalt binder from Hot Mix Asphalt (HMA) Plant from the line between the storage tank and the mixing plant while the plant is in operation, or from the delivery truck.

Emulsified asphalt via the sample valve of the delivery tanker trailer before it is pumped into the distributor, or take sample via the distributor sample valve spray bar or application device. Sample emulsified asphalt at delivery, (if possible). Sample container should be filled to its neck.

See fig. 1.1 and 2.1 on next slide

Field Sampling (continued)



Fig 1.1

Tanker-trailer



Fig 2.1

Distributor

Sampling valves

Field Sampling (continued)

- If there is no sampling valve on the distributor then the sample may be obtained via the manhole on the top of the distributor or by unscrewing one of the nozzles on the spray bar.
- Once obtained caution must be taken in handling the sample. The collected sample should not be shaken, agitated or handled roughly and should be transported to the testing facility as soon as possible.
- The container should have the following information written on it.
 - Material type/grade
 - Date Sampled
 - Location sampled from (tanker trailer, distributor or storage tank)
 - Batch Number and quantity shipped (if available)
 - A copy of the shipping ticket/bill of lading should accompany the sample, if available.

Thanks for your cooperation and your time!

FAQ

Q: Is there any health or safety precautions that should be exercised when using asphalt emulsions?

A: Avoid breathing fumes, vapors, and mist. Obtain a copy of the supplier's material safety data sheet (MSDS). Read the MSDS carefully and follow it.

Q: What are the primary reasons for testing and examining an asphalt emulsion?

A: There are three specific purposes for testing asphalt emulsions. They are as follows:

- To provide data for specification requirements

- To control the quality and uniformity of the product during manufacturing and use.

- To predict and control the handling, storage, and field performance properties of the material.

Q: What are some keys to a successful chip seal surface Treatment?

A: Coordinate construction to ensure continuous operation.

- Use hard, cubical, and clean aggregate.

- Properly calibrate application equipment.

- Maintain traffic control while chip seal application cures.

Q: What type of emulsion should be used for tack coats?

A: The type of emulsion used for tack coats varies from country to country. Normal practice in the USA is to use a slow-setting emulsion that is diluted with water before application. In many European countries cationic rapid setting (CRS) or specially designated low viscosity medium setting emulsions are used, **which are applied undiluted**.

◎ Sources

- The Heritage Group - <http://www.thginfo.com/index.htm>
- The Asphalt Institute - <http://www.asphaltinstitute.org/>
- AEMA — Asphalt Emulsion Manufacturers Association - <http://www.aema.org/>
- NC DOT QMS Manual - http://www.ncdot.org/doh/operations/materials/tschedule11/qms_manual2011/sect09a.html#b6
- NC DOT Road Oil – Liquid Bid Contract 2010-2011-1

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